

Transmission of SARS-CoV-2 in various school settings

TOM BECKER

NORTHWEST PORTLAND AREA INDIAN HEALTH BOARD

Game plan

- ▶ Review a few recent MMWR and other articles that relate to SARS-CoV-2 transmission (or lack thereof), given widely different settings (grade school, college, high school boarding school, sports teams, etc)

Objectives

- ▶ Cite evidence related to SARS-CoV-2 transmission in various school settings—risks, rates or prevalence, and mitigation strategies that are shown to be successful
- ▶ Describe how you would study Covid safety in schools where your own children may attend, or, in schools in your community


Take home messages

- ▶ School-based transmission risk appears to vary widely world-wide, but probably depends mostly on degree of mitigation put into place
- ▶ School-based transmission of SARS-CoV-2 can probably be substantially reduced when expensive, comprehensive, consistent, and enforced strategies are put into place...even when background community rates are high
- ▶ High risk behaviors among students at any grade level are likely to lead to high transmission rates

- ▶ Effective control of infection spread will require reducing risk of transmission from asymptomatic, as well as symptomatic, Covid-19 patients

Background

- ▶ Substantial news coverage on the topic of re-opening schools since pandemic began: what is 'safe' for schools re: re-opening, allowing sports, etc. ? What are the risky behaviors and environments? What do published data show from well-done studies? 3 feet vs 6 feet?
- ▶ Lab and epi data suggest that never symptomatic Covid-19 patients may be as likely as symptomatic persons to transmit SARS CoV-2 infection—a very important concern re: school openings
- ▶ Estimates of never symptomatic cases range from 0 to 50%, depending on the population and study reported



Recall from Wuhan study: Under most reasonable set of assumptions, based on meta-analysis-derived assumptions:

- ▶ 59% of all transmission is from asymptomatic persons, both categories of asymptomatic combined
- ▶ From patients who never develop symptoms: account for 24%
- ▶ From patients who eventually develop symptoms: account for 35%

Theory/ies for less severe illness in younger people that may be relevant to the opening of schools

- ▶ ACE2 receptors appear to be a docking station for SARS-CoV2
- ▶ Nasal biopsy study of 305 people aged 1-60 showed that ACE2 enzyme expression went up with increasing age
- ▶ Fewer receptors seems to track with less severe disease

Minimal transmission of SARS-CoV-2 in NJ Boarding school (MMWR, 2021)

- ▶ Boarding school with 520 on campus and 255 commuter students
- ▶ 405 faculty and staff
- ▶ Strategies included 14 day quarantine before coming to school, antigen test negative result 7-10 days before school, consistent masking, mandatory testing twice a week, increased ventilation in classrooms and dorms, distancing of 6 feet or more, contact tracing, isolation and quarantine of cases/contacts, hygiene
- ▶ All cafeteria meals take out only
- ▶ No interschool sports; no club sports allowed off campus
- ▶ Bluetooth device to assist contact tracing required

Boarding school, cntd

- ▶ Hand washing, symptom reporting (leading to testing right away)
- ▶ Signed “Best for all’ agreement
- ▶ Records of ‘bad acting’...’three strikes and you’re out!’...so a type of enforcement with consequences
- ▶ Intramural, on campus athletics were allowed, though masking still enforced for most sports and all spectators

Boarding school results

- ▶ 5% of faculty/staff were positive over the short study period
- ▶ 1% of students positive (n=8)
- ▶ Only two students likely to have picked up virus on campus...the remainder had 'traced exposures' to infected persons off campus
- ▶ Conclusion: extensive measures can work, in this type of setting

TABLE. SARS-CoV-2 testing results and tracing of cases and contacts at a school — New Jersey, August 20–November 27, 2020



SARS-CoV-2 testing results	Faculty/Staff members (n = 405)	Students (n = 775)
No. of specimens tested (average per person)	8,955 (22.1)	12,494 (15.1)
No. of RT-PCR-positive tests	19*	8
Specimens tested, %	0.21	0.06
Persons receiving testing, %	4.7	1.0
No. (%) of cases linked to on-campus transmission	0 (—)	2 (25) [†]
No. of contacts identified and quarantined	17	14
No. of contacts with positive test results	0	0

Boarding school study, limitations

- ▶ Generalizability
- ▶ Enormous expense to achieve good control
- ▶ Community background assessment of prevalence was not based on similar extensive testing

Florida SARS-CoV-2 infection after schools reopened (MMWR, 2021)

- ▶ Observational study of Covid cases in K-12 school children in Florida in the fall of 2020, after reopening
- ▶ Typical case surveillance in fall of 2020—over 63,000 cases
- ▶ Reported risk factors, some associated with community incidence rates

Florida report, cntd

- ▶ Covid-19 incidence in schools was correlated with county incidence, distribution of mask-wearing mandates, and with timing of reopening (early 'adapters' at higher risk)
- ▶ Incidence increased with in-person attendance
- ▶ <1% of all students acquired SARS-CoV-2 in association with school exposures/outbreaks
- ▶ 10% of all schools reported infections

Factor	Student rate*	P-value
County population size by quartile[†]		
Q1: 8,613–28,089	2,212	<0.0001
Q2: 28,090–130,642	1,430	
Q3: 130,643–368,678	1,226	
Q4: 368,679–2,830,500	970	
Opening date		
August 10–14	1,882	0.01
After August 16	1,367	
Masks mandated in district reopening plan[§]		
Yes	1,171	<0.01
No	1,667	

Limitations, Florida study

- ▶ No info on school faculty/staff and their positivity and potential for transmission to students
- ▶ No widespread testing, so asymptomatic cases missed
- ▶ Incomplete case evaluations re: sources of infection
- ▶ Uncertain locations of acquiring infections
- ▶ Limited data on school district by district for comparisons
- ▶ Most students in the larger school districts were 'late adaptors' of in-person education

Additional studies worth noting

- ▶ An un-named 'large university in Washington', experienced an alarming outbreak on campus in their longitudinal study (over 16,000 participants)...limited mostly to fraternities and sororities.
- ▶ High school football team outbreak, also related to risky behavior and environmental conditions (masking violations, poor disinfection protocol adherence in weight rooms and locker rooms, distancing violations in communal spaces)
- ▶ Countless examples of school outbreaks nationwide and worldwide

Summary points

- ▶ Risky transmission behavior in high schools and colleges result in disease outbreaks—mitigation possible, however
- ▶ Some of the published data reflect low transmission risk in grade schools, middle schools, and high schools (in England), and that community background prevalence is reflected in the schools
- ▶ A very rigorous prevention strategy, including distancing, masking, frequent testing, limited contact off campus, enforced punishment for safety violations ...can reduce SARS-CoV-2 transmission among youth grades 9-12 (from NJ study)
- ▶ We still are missing RCT's to guide most of our recommendations as public health and clinical practitioners

CDC website information

- ▶ CDC has review of mitigation strategies related to in person school attendance and mitigation strategies for schools/school systems
- ▶ Pragmatic, and considers expense and other relevant factors related to in-person attendance
- ▶ See reference section link

Take home test

- ▶ How would you design an actual study (not theoretical) to evaluate transmission of SARS-CoV-2 in schools near you? Which behavioral, environmental, and biological factors would you consider to be important?

References

- ▶ “SARS-CoV-2 epidemiology on a public university campus in Washington State,” Weil et al. Preprint available at *medRxiv*. <https://www.medrxiv.org/content/10.1101/2021.03.15.21253227v1>
- ▶ “Minimal SARS-CoV-2 transmission after implementation of a comprehensive mitigation strategy at a school—New Jersey, August 20–November 27, 2020,” Volpp et al *MMWR*. <http://dx.doi.org/10.15585/mmwr.mm7011a2>
- ▶ “Notes from the field: SARS-CoV-2 transmission associated with high school football team members—Florida, September–October 2020,” Siegel et al. *MMWR*. <http://dx.doi.org/10.15585/mmwr.mm7011a3>
- ▶ “SARS-CoV-2 infection and transmission in primary schools in England in June–December, 2020 (sKIDs): an active, prospective surveillance study,” Landhani et al. *Lancet*. [https://www.thelancet.com/journals/lanchi/article/PIIS2352-4642\(21\)00061-4/fulltext](https://www.thelancet.com/journals/lanchi/article/PIIS2352-4642(21)00061-4/fulltext)

Refs, cntd

- ▶ “Operational strategy for K-12 schools through phased prevention,”
<https://www.cdc.gov/coronavirus/2019-ncov/community/schools-childcare/operation-strategy.html>